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EARTH SCIENCE SERVICES FOR ENERGY

Wind and Solar Energy

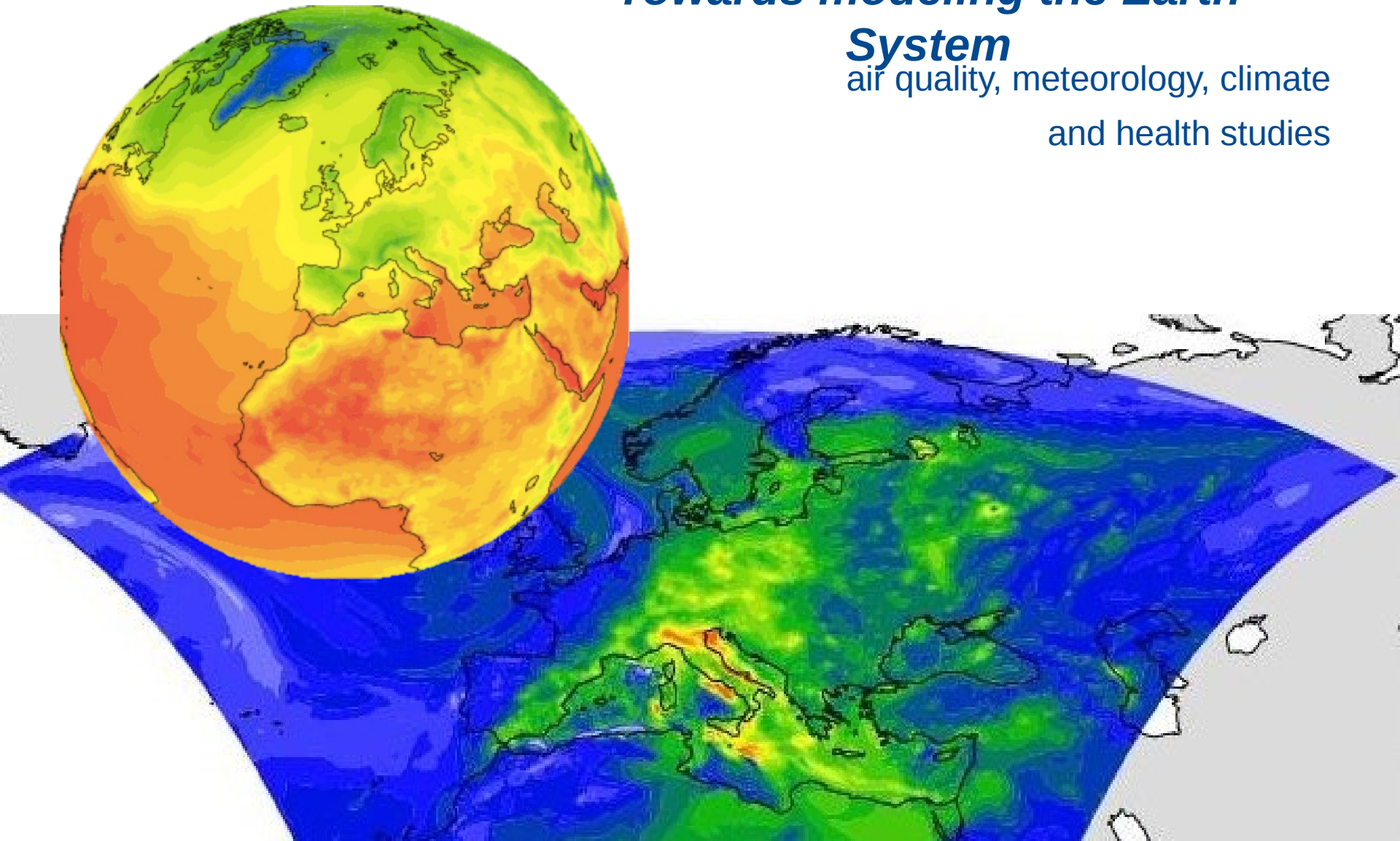
Isadora Christel Jiménez
Services – Earth Science Department



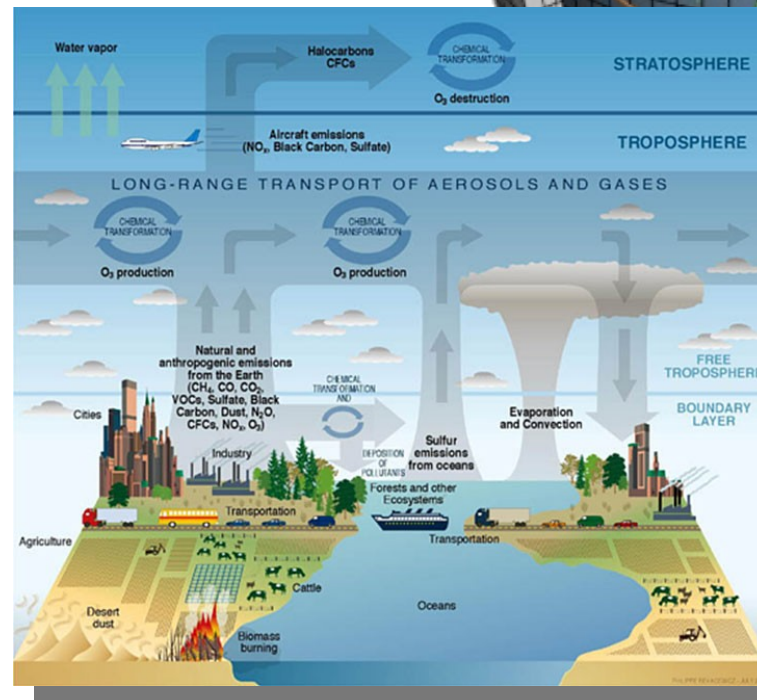
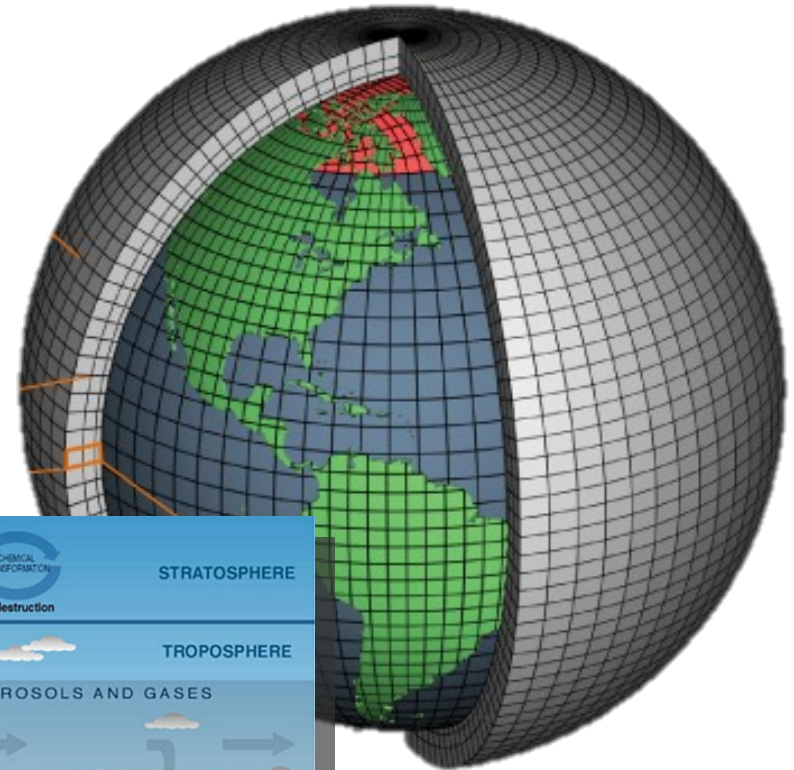
Towards modeling the Earth

System

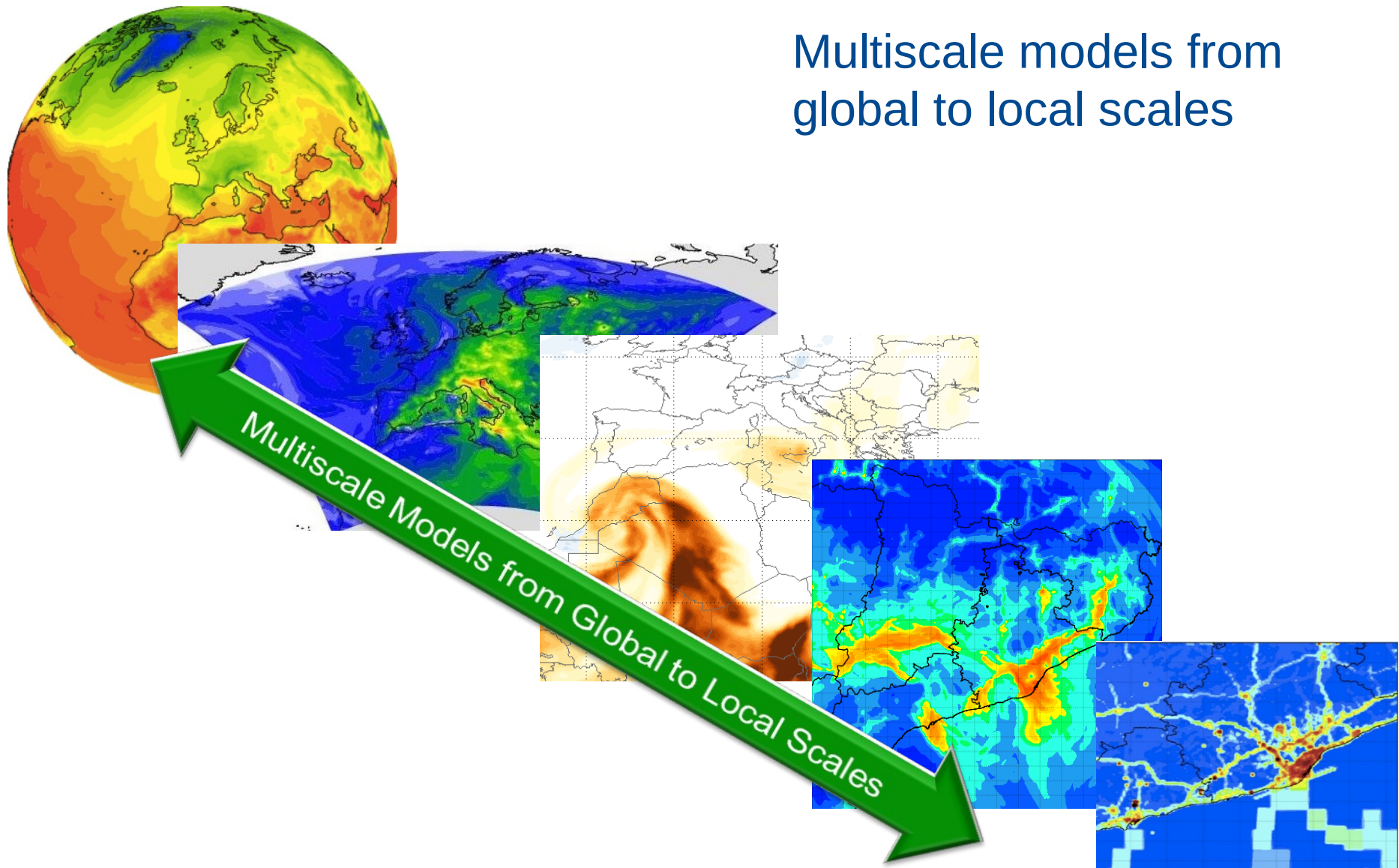
air quality, meteorology, climate
and health studies



- **Atmospheric composition modelling**
 - atmospheric dynamics
 - emission models
 - meteorological models
 - air quality models
- **Climate prediction modelling**
- **Computational Earth Sciences**
- **Services**



Multiscale models from global to local scales

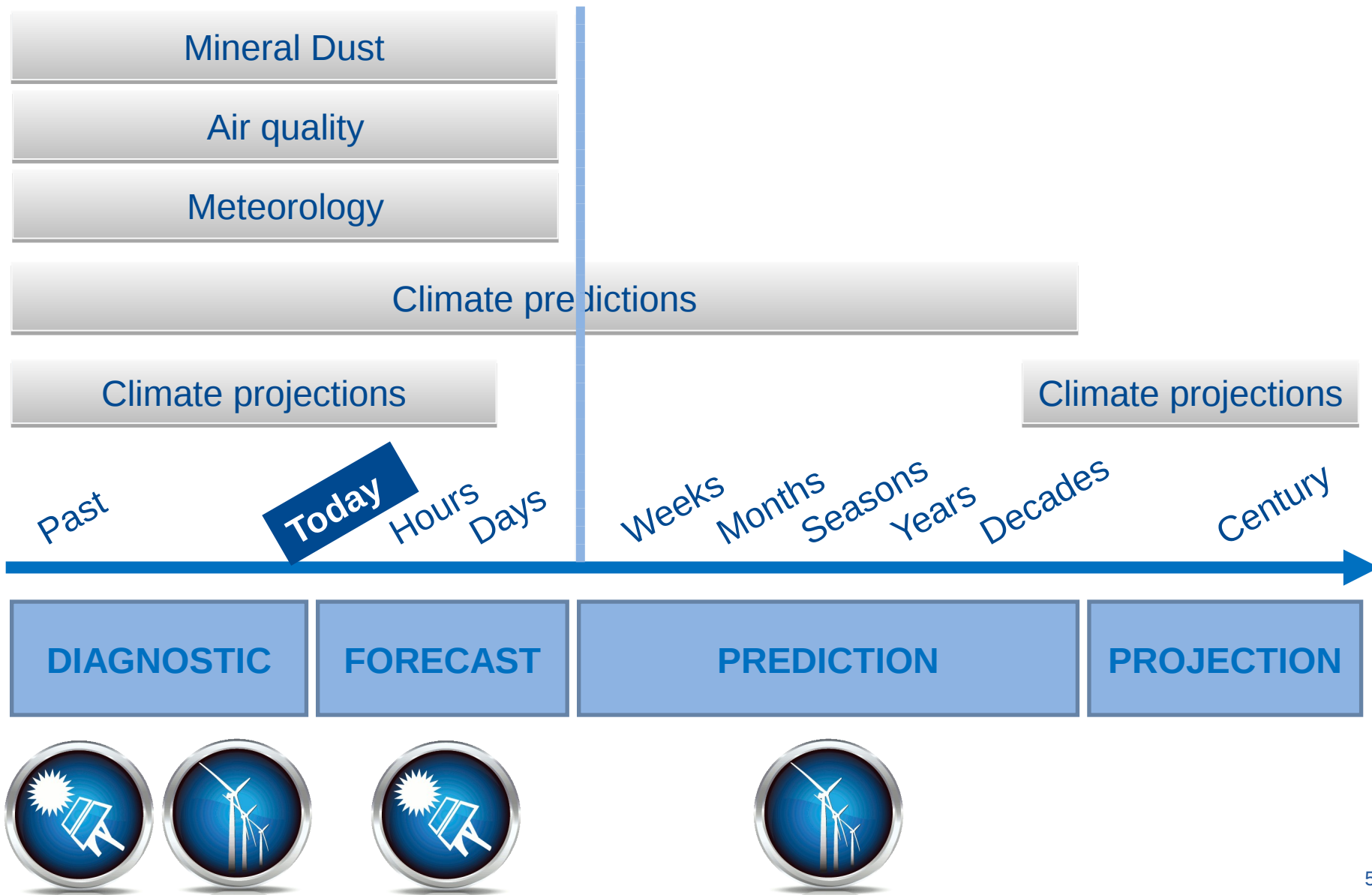


Temporal scales



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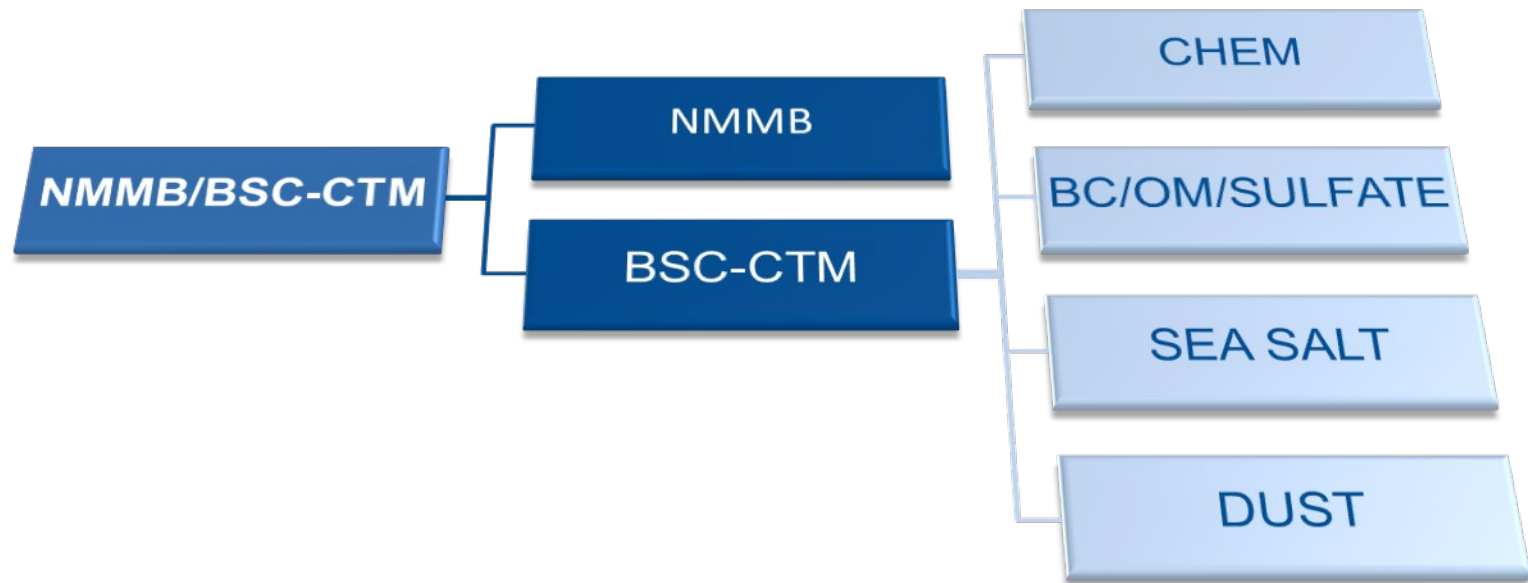
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SOLAR ENERGY

We have developed **in collaboration with NCEP (USA)** the NMMB/BSC-CTM model

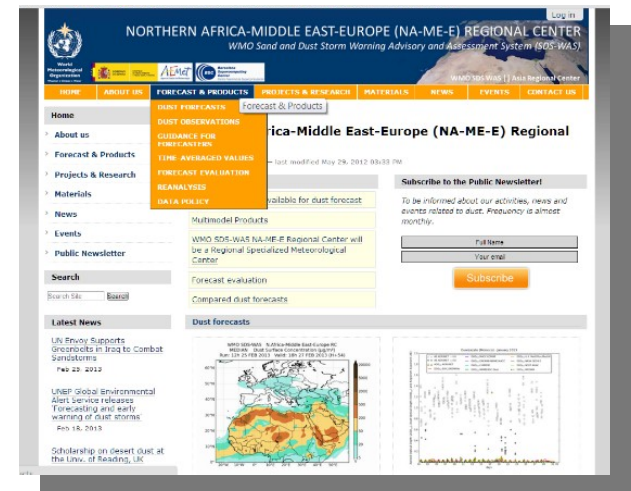


- **Multi-scale:** global to regional scales
- Full **on-line** coupling: weather-chemistry feedback processes
- Enhancement with a **data assimilation** system

Mineral dust forecasts SDS-WAS North Africa, Middle East and Europe Regional Center

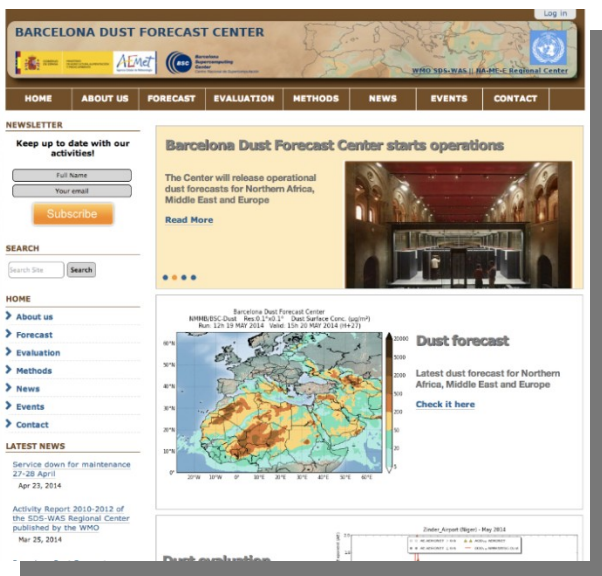
Early warning system

<http://sds-was.aemet.es> started in 2010



Barcelona Dust Forecast Center

First specialized WMO Center for
mineral dust prediction
<http://dust.aemet.es> started in 2014



EL MUNDO

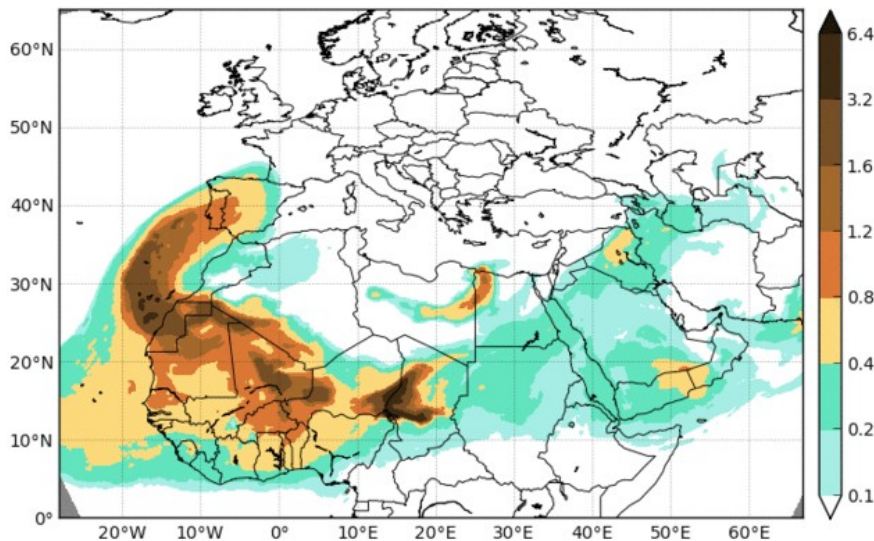
Edición España ▼ Versión Clásica ▼

SECCIONES Ciencia Natura

METEOROLOGÍA Altas temperaturas desde comienzos de mayo

Una ola de calor y polvo sahariano adelanta el verano dos meses

Barcelona Dust Forecast Center
NMMB/BSC-Dust Res:0.1°x0.1° Dust AOD
Run: 12h 10 MAY 2015 Valid: 00h 13 MAY 2015 (H+60)



Animación que representa cómo entrará en la Península la nube de polvo sahariano. | BDFC

MIGUEL G. CORRAL

Actualizado: 12/05/2015 03:02 horas

9

El Mundo, yesterday.
12/5/2015

<http://www.elmundo.es/ciencia/2015/05/12/5550f5f3268e3edf1e8b4577.html>

Mineral dust modelling for solar energy management



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On-line feedbacks: Dust-radiation interaction

- Real value
- Model + Climatology
- Model + Dust

Forecast and diagnostic mode

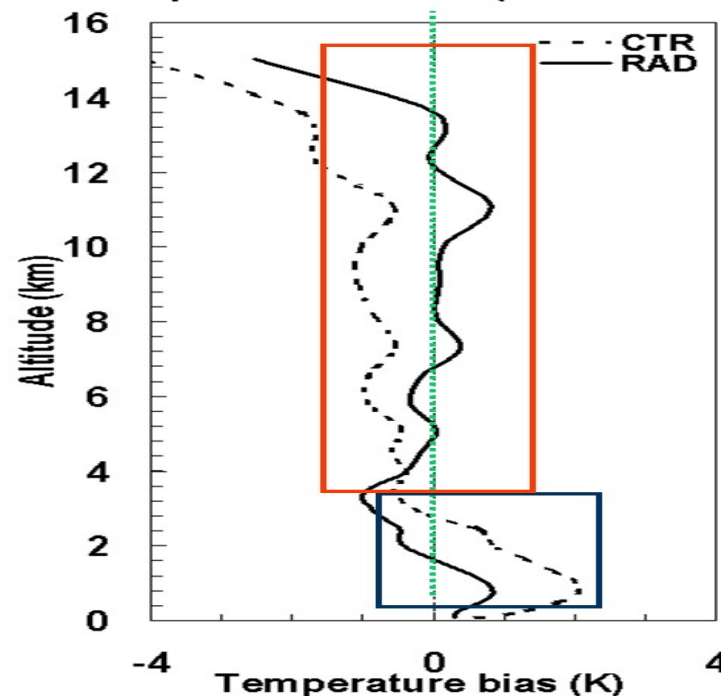
Today

DIAGNOSTIC

FORECAST

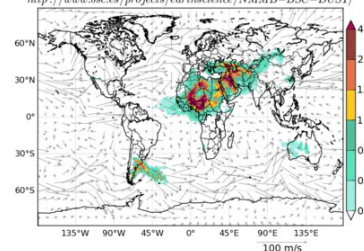
Regional and global scales

BIAS 13 April 2002 at 00UTC (24h forecast)



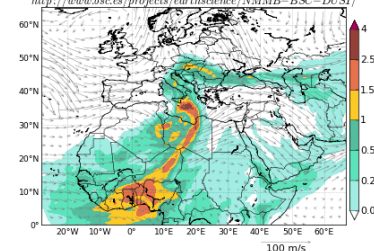
NMMB/BSC-Dust Dust Load (g/m^2) and 700 hPa Wind
18h forecast for 18UTC 12 Feb 2015

<http://www.bsc.es/projects/earthscience/NMMB-BSC-DUST/>



NMMB/BSC-Dust Dust Load (g/m^2) and 700 hPa Wind
18h forecast for 06UTC 21 Feb 2014

<http://www.bsc.es/projects/earthscience/NMMB-BSC-DUST/>



PRE-CONSTRUCTION - Diagnostic and Forecast system

Geographical information to decide the site location of future solar power plants

POST-CONSTRUCTION - Forecasts system

to prevent energy loss and improve the management of solar power plants

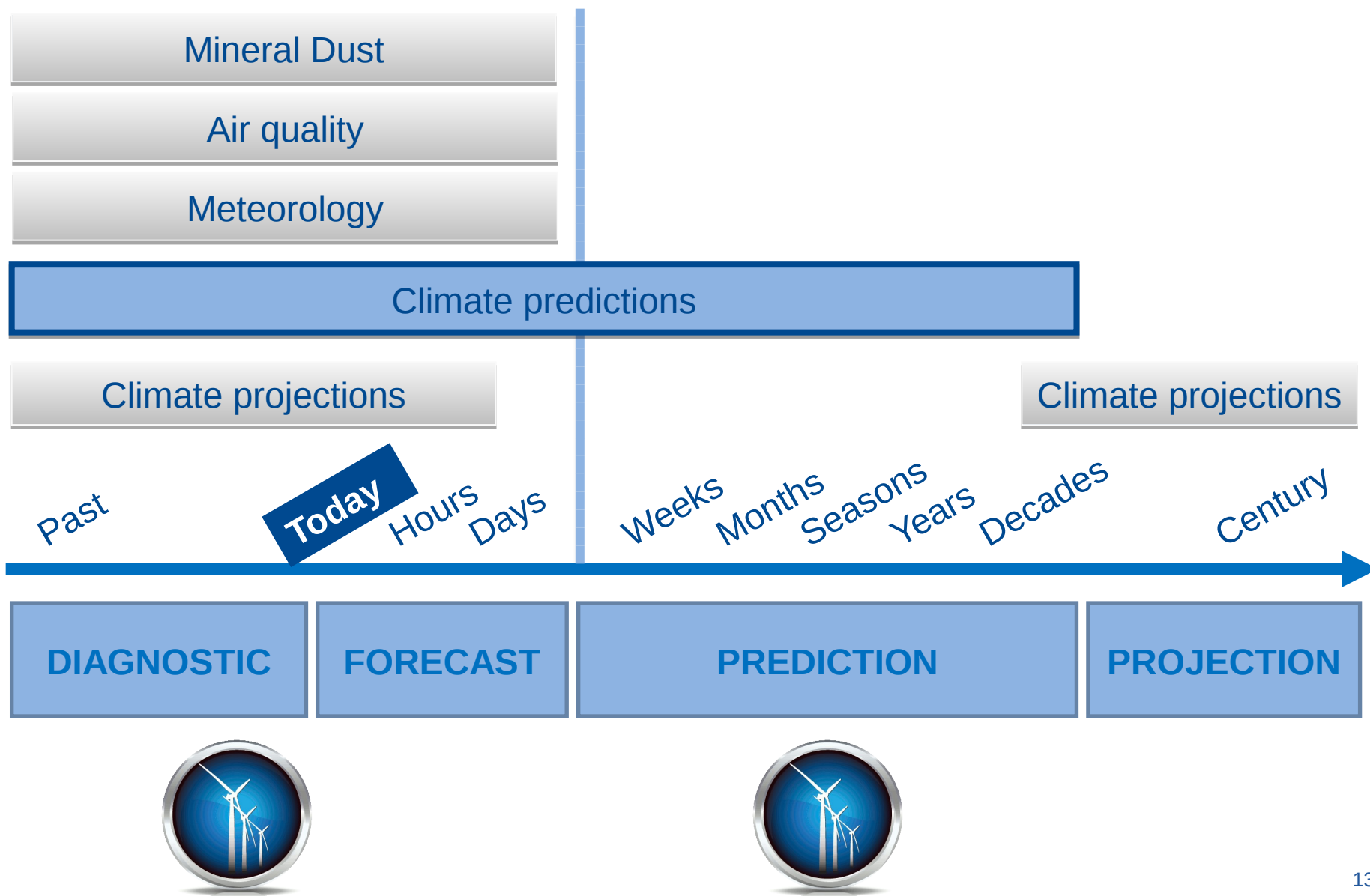


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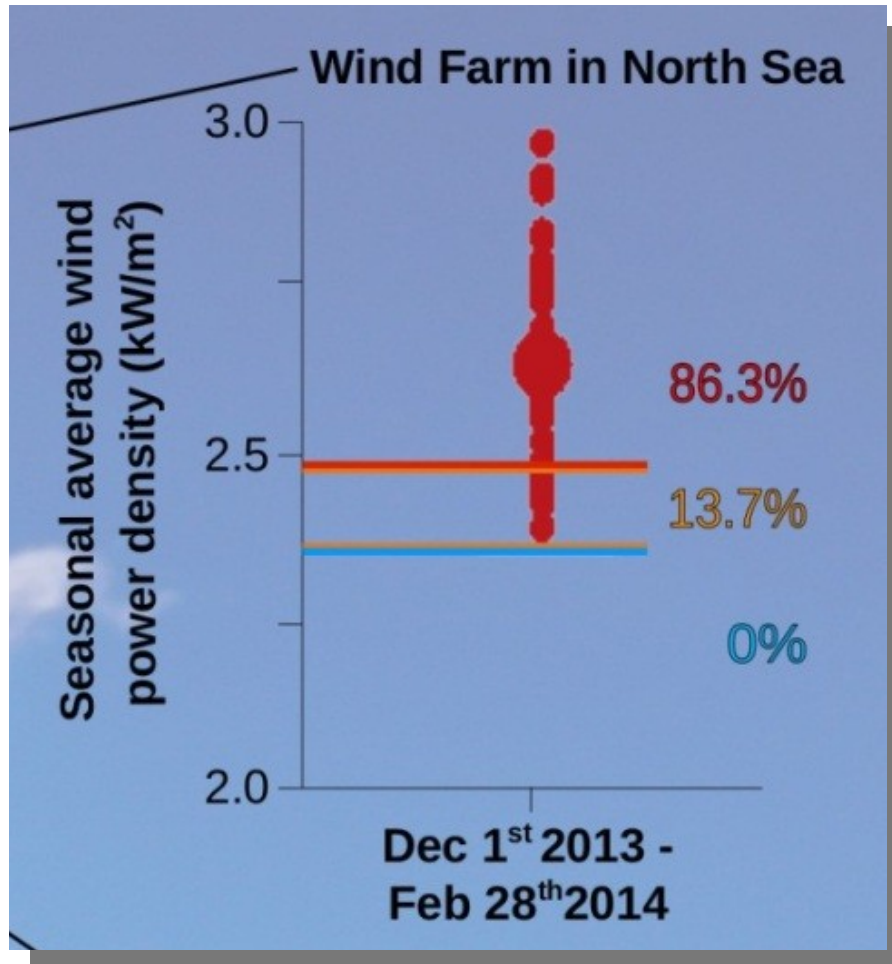
WIND ENERGY



- Wind farms viability plans are in a decadal timeframe (10-15 years)
- Need for sub-seasonal, seasonal and decadal climate predictions, new field in climate predictions
- Worldwide only BSC-ES + Met Office work in this timeframe
- Partners in European projects (FP7 and H2020) in collaboration with private wind sector (EDPF, Vortex, EDPR...)

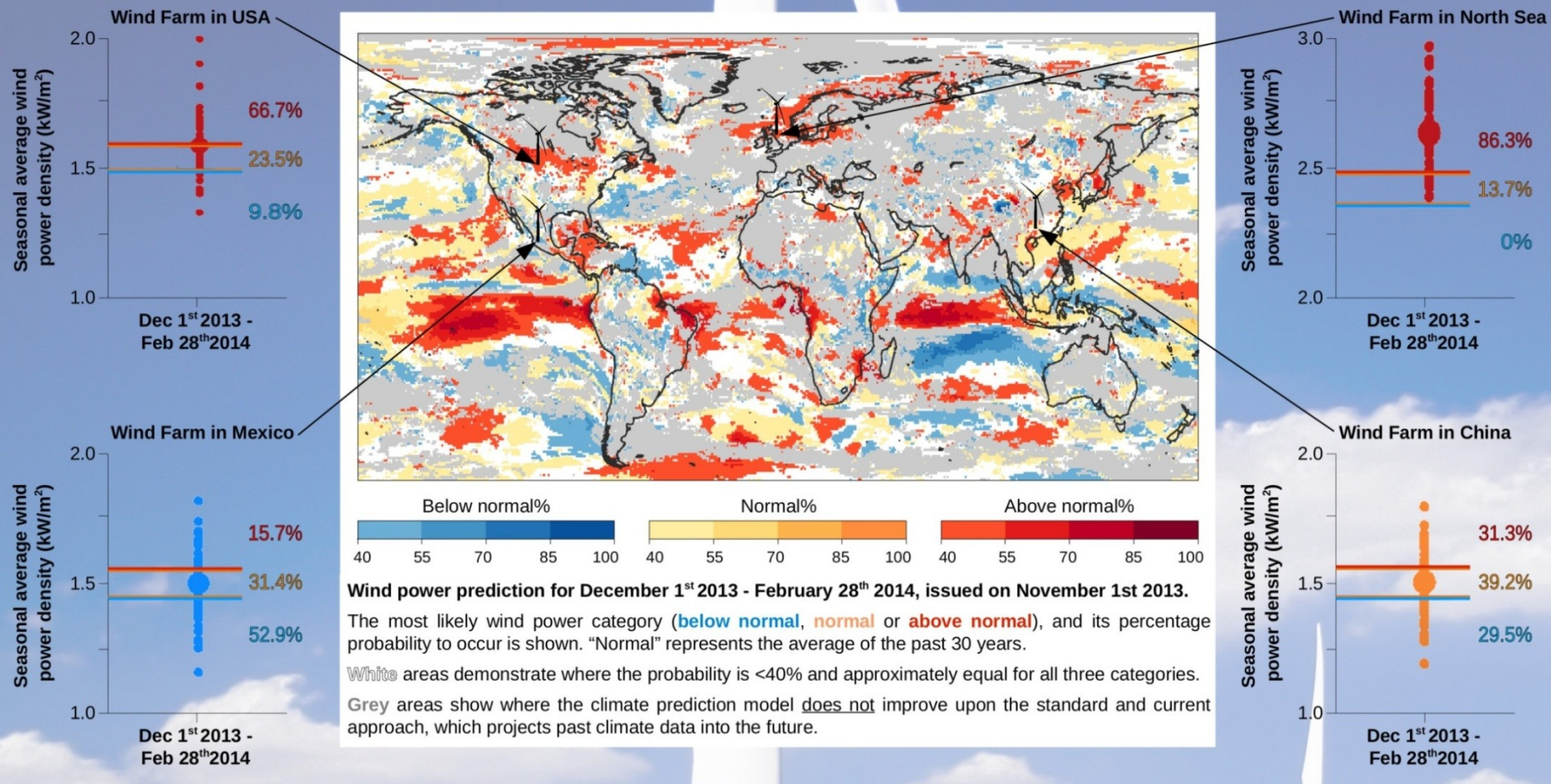
EUPORIAS





- **We don't provide** deterministic predictions
- Data from ECMWF (European Centre for Medium-Range Weather Forecasts)
- We run multiple models and assess the global behaviour providing a **probabilistic predictions**
- Aggregated output in terciles
 - Above normal
 - Normal
 - Below normal

Illustrative examples of seasonal wind power predictions



A photograph of a wind farm with several white wind turbines against a clear blue sky. The turbines are arranged in a line, receding into the distance.

ANNUAL TO DECADEAL TIMESCALES

Wind farm planners: Site selection

Wind farm investors: Evaluate return on investments

Policy makers: Understand changes to energy mix

MONTHLY TO SEASONAL TIMESCALES

Energy producers: Resource management strategies

Energy traders: Resource effects on markets

Wind farm operators: Planning for maintenance works



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Thank you!

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